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Comparison of pre- and post-education video laryngoscope and direct laryngoscope skills of medical school students: A manikin study

Video or direct laryngoscope for medical students

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Abstract

Aim: Video laryngoscope (VL) has a lot of advantages over direct laryngoscope (DL). In this study, our aim was to compare the skills of medical students with VL and DL before and after education.

Material and Methods: The 5th-grade students performed VL and DL before and after education. Success rates and timings were recorded pre- and post-education. Then, the groups were compared.

Results: A total of 104 Medical school students were involved in the study. The rates of students who were successful in video laryngoscopy pre-education were significantly higher than the rates of students who were successful in DL (61.5% vs 36.5%, respectively). The rates of students who were successful in post-education DL and VL applications were not different. The post-education completion times of DL and VL were significantly reduced when compared to pre-education completion times. There was not any statistical significance between the completion times of DL and VL after the education. Of the students, 61 (58.7%) who were unsuccessful in DL pre-education were successful post-education. The effect of education was statistically significant ($p<0.001$). Thirty-five (33.7%) students who were unsuccessful in VL pre-education were successful post-education. The effect of education was statistically significant ($p<0.001$).

Discussion: Video laryngoscope is a viable option for inexperienced users. More emphasis should be placed on this procedure within medical education.

Keywords

Direct Laryngoscopy, Video Laryngoscopy, Manikin Model, Airway Management

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Introduction

Tracheal intubation is used as a common airway method when basic airway methods are insufficient. There are many studies showing that video has a better chance of success on the first try in emergency airway management [1]. Over the past 30 years, laryngoscopes have also developed in parallel with the development of technology particularly with regard to computer and fiber optic technology. Each new development in visualization builds on the development of the previous technology. Considering the good patient outcomes, it seems that video laryngoscope (VL) has been gaining popularity rapidly recently. However, the question remains related to its daily use [2]. Although VLs are available in many clinical settings, it remains unclear if their use reduces the incidence of failed tracheal intubation compared with conventional direct laryngoscopy (DL) in routine airway management [3]. Early studies of VL focused on the novice laryngoscopist or the patient predicted to be difficult to intubate by DL. However, today it is discussed that video should be used as a priority [4]. In this study, we aimed to compare the ease of use and learnability of VL and DL among medical students. In addition, in this study, we compared the success of both methods in intubation interventions performed by medical students before and after education and their preference by students.

Material and Methods

Ethical approval for the study was granted by the Non-Interventional Research Ethics Committee of Hitit University (decision no: 2023-01, dated: 28.02.2023). We conducted this study among 5th-grade students at a university hospital. The study was conducted between 01/01/2022 and 01/01/2023. A total of 140 students were involved in the study. Written consent was obtained from the students. Demographical properties, chronic diseases, perspectives on procedures were recorded. The students performed VL (McGrath®) and DL (MAC 2®) before and after education. Each education period was restricted to 15 minutes of theoretical and practical demonstration. Success rates and timings were recorded pre- and post-education. Then, the groups were compared.

Statistical analyses

Statistical analyses of the data collected in our study were conducted using the SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA) software. Descriptive statistics were reported using numbers (n) and percentage (%) for categorical variables, and mean ± standard deviation (min - max) for numerical variables. Proportion comparisons between categorical variables were performed with the Chi-square test. Proportion comparisons between the categorical variables before and after the training were performed with the Mc-Nemar test. The conformity of the numerical data to the normal distribution was examined using the Shapiro-Wilk and Kolmogorov-Smirnov tests. The homogeneity of variances was evaluated with Levene's test. Comparison of numerical data between two independent groups was performed with Student's t-test, since parametric test assumptions were met.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

A total of 104 medical school students were involved in the study. The mean age of the students was 23.23±0.95 years (min-max: 21-26). Of these students, 34.6% (n=36) were male and 65.4% (n=68) were female; 62.5% (n=65) of the students had an ophthalmic disease; 50% (n=18) of male students and 69.1% (n=47) of female students declared an ophthalmic disease. There was no statistical significance between genders in terms of ophthalmic disease (p=0.055). Of the students, 39.4% (n=41) stated that they had received training in airway management in the past. When their experiences on devices were investigated, 69.2% (n=72) were educated in DL and 26% (n=27) were educated in VL. When students were asked: "Which method would you prefer?", 72.1% (n=75) answered as VL and 27.9 (n=29) answered as DL. Of the male students, 69.4% (n=25) preferred VL and 30.6% (n=11) preferred DL. Of the female students, 73.5% (n=50) preferred VL and 26.5% (n=18) preferred DL. There was no statistical significance between genders in terms of method choice (p=0.659). Both individuals from two genders preferred DL.

Statistical data regarding the comparison of DL and VL procedure success pre- and post-education for DL and VL are presented in Table 1. Pre-education DL intervention was successful in 7 students on the 1st attempt, in 19 students on the 2nd attempt and in 12 students on the 3rd attempt. The overall success rate was 36.5% (n=38). Pre-education VL intervention was successful in 33 students on the 1st attempt, in 21 students on the 2nd attempt and in 10 students on the 3rd attempt. The overall success rate was 61.5% (n=64). Bar graphs show the number of students according to the seconds of successful completion of direct and video laryngoscopy before and after the training (Figure 1, 2).

The rates of students who were successful in VL pre-education were significantly higher than the rates of students who were successful in DL (p<0.001, Table 1). After the education, a total of 96 (92.3%) students successfully completed DL, 42 on the first attempt, 38 on the 2nd attempt, and 16 on the 3rd attempt. A total of 96 (92.3%) students successfully completed the post-training VL application, 57 on the 1st attempt, 29 on the 2nd attempt and 10 on the 3rd attempt. The success rates of students who were successful in post-education DL and VL applications were not statistically different (p=1.000, Table 1).

Statistical findings for the comparison of the success time of direct and VL applications by students pre- and post-education are presented in Table 2. The time to complete DL pre-education was 26.29±3.81 (21-30) on the 1st attempt, 25.68±5.62 (14-30) on the 2nd attempt, and 26.17±3.85 (20-30) on the 3rd attempt, in total of 25.95±4.71 (14-30).

The time to complete the pre-education VL application was 22.7±5.85 (11-30) on the 1st attempt, 21.95±6.83 (12-30) on the 2nd attempt, and 21.40±7.96 (5-30) on the 3rd attempt, with a total of 22.25±6.44 (5-30) times. DL completion times of students' pre-education were significantly higher than VL completion times (p=0.003, Table 2). The time to complete the DL application post-education was 20.19±6.57 (5-30) on the 1st attempt, 19.92±7.34 (7-30) on the 2nd attempt, and 20.88±5.73

Table 1. Statistical findings on the comparison of the success rates of direct laryngoscopy and video laryngoscopy applications before and after training.

		Direct laryngoscopy		Video laryngoscopy		P values
	Attempt	Unsuccessful	Successful	Unsuccessful	Successful	
Pre	First	97	7	71	33	
	Second	78	19	50	21	
	Third	66	12	40	10	
	Total	66 (63.5%)	38 (36.5%)	40 (38.5%)	64 (61.5%)	<0.001
Post	First	62	42	47	57	
	Second	24	38	18	29	
	Third	8	16	8	10	
	Total	8 (7.7%)	96 (92.3%)	8 (7.7%)	96 (92.3%)	1.000

Chi-square test

Table 2. Statistical findings for the comparison of the times of direct laryngoscopy and video laryngoscopy successfully completed before and after the training.

	Attempt	Direct laryngoscopy		Video laryngoscopy		P values (between)
		n	Mean±SD (min-max)	n	Mean±SD (min-max)	
Pre	First	7	26.29±3.81 (21-30)	33	22.7±5.85 (11-30)	
	Second	19	25.68±5.62 (14-30)	21	21.95±6.83 (12-30)	
	Third	12	26.17±3.85 (20-30)	10	21.40±7.96 (5-30)	
	Total	38	25.95±4.71 (14-30)	64	22.25±6.44 (5-30)	0.003
Post	First	42	20.19±6.57 (5-30)	57	18.95±7.23 (6-30)	
	Second	38	19.92±7.34 (7-30)	29	18.76±8.39 (5-30)	
	Third	16	20.88±5.73 (11-30)	10	19.3±5.83 (8-25)	
	Total	96	20.20±6.70 (5-30)	96	18.93±7.41 (5-30)	0.214
	P values (within)		<0.001		0.004	

Student's t-test

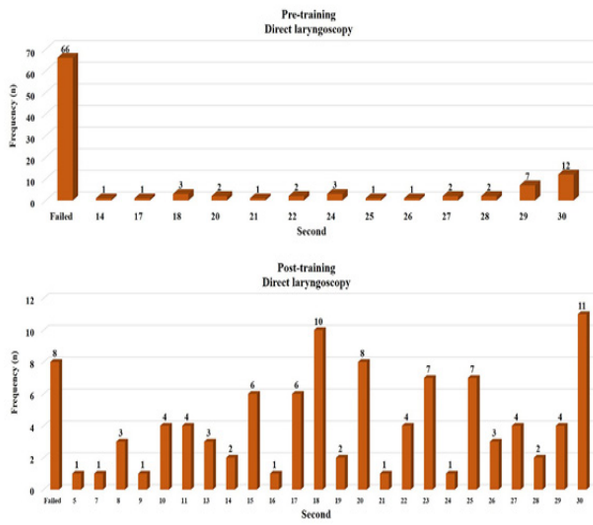

Figure 1. Bar graph showing the number of students according to the seconds of successful completion of direct laryngoscopy before and after the training.

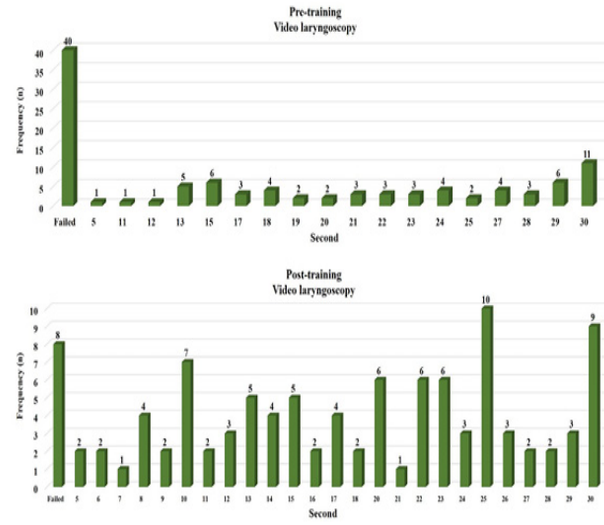

Figure 2. Bar graph showing the number of students according to the seconds of successful completion of video laryngoscopy before and after the training.

Table 3. Statistical findings for the comparison of the success rates of direct laryngoscopy and video laryngoscopy before and after the training.

Direct laryngoscopy			Post		Total	P value
			Unsuccessful	Successful		
Pre	Unsuccessful	n	5	61	66	<0.001
		%	4.8%	58.7%	63.5%	
	Successful	n	3	35	38	
		%	2.9%	33.7%	36.5%	
Total		n	8	96	104	
		%	7.7%	92.3%	100%	
Video laryngoscopy						
Pre	Unsuccessful	n	5	35	40	<0.001
		%	4.8%	33.7%	38.5%	
	Successful	n	3	61	64	
		%	2.9%	58.7%	61.5%	
Total		n	8	96	104	
		%	7.7%	92.3%	100%	

Mc-Nemar test

(11-30) on the 3rd attempt, with a total of 20.20±6.70 (5-30) times. The time to complete the VL application post-education was 18.95±7.23 (6-30) on the 1st attempt, 18.76±8.39 (5-30) on the 2nd attempt, and 19.3±5.83 (8-25) on the 3rd attempt, with a total of 18.93±7.41 (5-30) times.

There was no statistical significance between the completion times of DL and VL after the education (p=0.214, Table 2). The post-education completion times of DL were significantly reduced compared to pre-education completion times (p<0.001, Table 2). The post-education completion times of VL were significantly reduced compared to pre-education completion times (p=0.004, Table 2).

In order to determine the effect of training on laryngoscopy success, the success rates pre- and post-education were compared; DL and VL results are presented in Table 3. Of the students, 61 (58.7%) who were unsuccessful in DL pre-education were successful post-education. The effect of education was statistically significant (p<0.001, Table 3). Thirty-five (33.7%) students who were unsuccessful in VL pre-education were successful in post-education. The effect of education was statistically significant (p<0.001, Table 3).

Discussion

The results of our study revealed that all students prefer VL. The overall success rate was higher with VL in both pre- and post-education groups. There was no statistical significance between the completion times of DL and VL after the education. Direct laryngoscopic completion times of students pre-education were significantly higher than VL completion times.

Since we conducted our study among students, we preferred to use an endotracheal intubation manikin to avoid any patient harm. In another manikin simulator study, 28 anesthetists and 28 anesthesia nurses performed a tracheal intubation with VL and DL on a manikin simulator during ongoing chest compressions by a mechanical resuscitation device. First-pass success rate was 100% in the video laryngoscopy group and 67.8% in the direct laryngoscopy group. The median time for intubation was 27.5 seconds in the VL group and 30.0 seconds in the DL group. Similar to our results, the manikin study on tracheal intubation during ongoing chest compressions demonstrated that VL had a higher first-pass success rate and shorter time to successful intubation compared to DL [1].

In a meta-analysis comparing VL and DL, 64 studies with 7044 adult participants were included. Video laryngoscope was found to be associated with significantly fewer laryngeal or airway traumas [5].

Video laryngoscopes may reduce the number of failed intubations, particularly among patients presenting with a difficult airway. They concluded that VL may improve the glottic view and may reduce laryngeal/airway trauma [6].

Our study has shown that video is easier to apply and preferred by students in first attempts and in uneducated individuals.

In a study, 150 patients were subdivided into two groups according to the intubation method: the VL group and the DL group. The duration for the vocal cord appearance was significantly shorter in the VL group than in the DL group. Also, the beginning of intubation to full ventilation of the lungs was significantly shorter in the VL group than in the DL group [7]. Another multi-centered study with 2092 adult patients demonstrates that using VL compared with DL improved first-pass tracheal intubation success in patients having elective surgery. As a result, the authors recommended practitioners to use this device as their first choice for tracheal intubation [3]. In our study, we revealed that the success rate of the VL is higher, although it was not determined after the training between video and the other in terms of duration in post-education trials.

In a meta-analysis, first pass success was higher in VL than in DL. Clinical trials showed a shorter time to achieve successful intubation with the VL. Video laryngoscope was also superior in terms of avoiding cessation of chest compressions. In concordance with our study, it was concluded that when clinicians with limited intubation experience have to perform

tracheal intubation during advanced life support, the use of the VL improved intubation. It was also concluded that CPR performance improved with VL compared to DL [8].

Despite these advantages, however, the success of VL in the congenital difficult airways is controversial. In a study in which Pierre Robin Syndrome was created, VL was less successful compared to DL [9]. Additionally, a study with paramedics reported that VL caused longer endotracheal intubation time. The intubation times performed by paramedics in UESCOPE® and ProVu® were significantly longer than those with the I-view and Macintosh laryngoscopes [10]. Video laryngoscope also helps reduce the number of intubation attempts. A study with 94 participants revealed that the success rate of VL during the first attempt was significantly higher. View of the vocal cords was significantly better, and perceived subjective safety was increased using VL [11]. In a study, anesthesia residents performed VL and DL on pediatric patients. A total of 105 intubations with the VL and 106 DL were performed by the residents. The success rate on the first attempt with the VL was 81%, and the success rate on the first attempt within a given time limit of 30 s was 45%, which was lower than with DL (93% and 77%). However, intubation with DL was significantly faster. The authors concluded that VL took longer time to intubate compared to DL. As a result of this pediatric manikin model, they did not recommend VL for learning pediatric intubation by residents [12]. Despite the mentioned disadvantages of VL in some studies, it also has superiorities to DL such as allowing a distance between the patient and the physician [13]. In the pandemic era, this phenomenon becomes even more important. As an observational result of our study, we determined that participants could achieve advanced airway with VL from a distance. In the DL group, contrarily, participants needed to get closer to the patient for a better view, which may cause overexposure to potential viral spread.

Our study revealed that VL is more advantageous for uneducated and inexperienced performers. However, more solid data are needed to say that it should completely replace DL. Education on DL to medical students should continue, but their experience with video should also be increased. Video laryngoscope should be considered not only as a good alternative but also as an essential tool for advanced airway management.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

The authors declare no conflict of interest.

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